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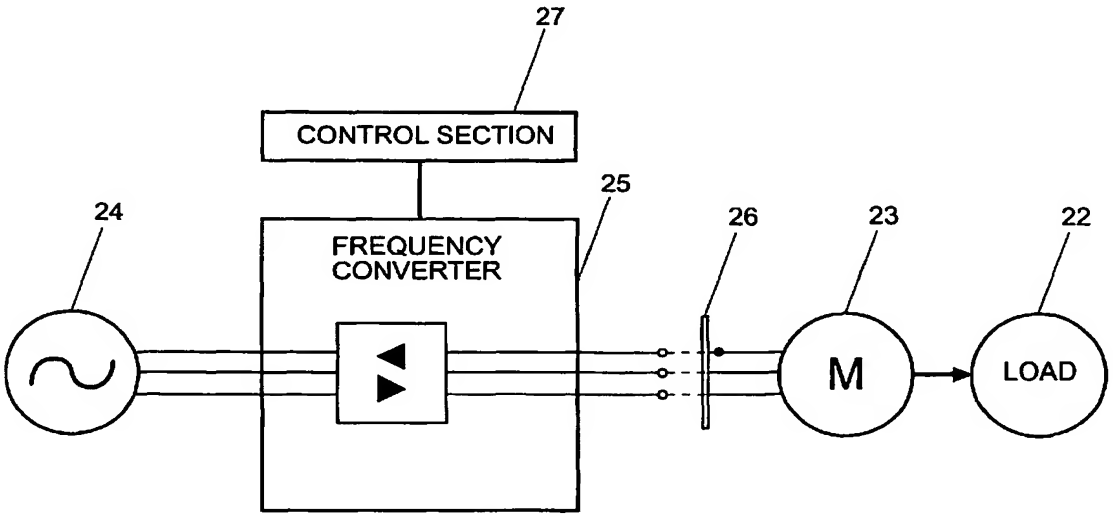
(54) Title: SYSTEM AND METHOD FOR BRAKING A MOTOR OF A PROPULSION UNIT



(57) Abstract: The present invention relates to a propeller drive arrangement for vessels used in water-borne traffic, and specifically to a propeller drive arrangement containing a propulsion unit, and to such an arrangement, which contains a propulsion unit, which is turnable relative the hull of the vessel. Particularly the present invention relates to a system and a method for braking a motor of a propulsion unit. The solution for braking the propulsion unit according to the present invention is based on short-circuiting a permanently magnetized motor.

WO 03/084045 A1

For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.

System and method for braking a motor of a propulsion unit

Field of the invention

The present invention relates to a propeller drive arrangement for vessels used in water-borne traffic and specifically to a propeller drive arrangement, which comprises a propulsion unit. The invention further relates to an arrangement comprising a propulsion unit, which is rotatable in relation to the hull of the vessel. The invention further relates to a system and a method for braking, i.e. reducing the speed and/or limiting the motion of a motor of a propulsion unit.

Background of the present invention

In the most common cases the propulsion of various ships or equivalent vessels (such as e.g. passenger ships and passenger ferries, cargo ships, barges, oil tankers, ice breakers, off-shore vessels, naval ships etc.) is achieved by a pushing or pulling force produced by a rotatable propeller or several propellers. Separate rudder devices have conventionally been used for steering the vessels.

Conventionally the driving or rotating arrangements for the propellers have been implemented such, that the drive device for the propeller shaft, e.g. a diesel engine, a gas engine or an electric motor is provided inside the hull of the vessel, from which location the propeller shaft extends outside the hull of the vessel through a watertight sealed opening. The propeller itself is located at the other end, i.e. the end extending outside the vessel, of the propeller shaft, which is connected either directly to the motor or to a gearbox, if any. In the majority of all vessels used in water-

borne traffic this solution is used for providing the force necessary for their movement.

Prior art is described below with reference to the accompanying drawings, in which:

Figure 1 shows the structure of a propulsion unit according to prior art,

Figure 2 shows a prior art propulsion unit with its turning arrangement, and

Figure 3 shows a prior art arrangement for supplying power to propulsion units.

Figure 1 shows the structure of a propulsion unit according to prior art. The prior art propulsion unit comprises a motor 1, a propeller 2, and a chamber 3, which is connected to the hull 5 of the ship by a hollow shaft 4. Shipbuilders have lately started to provide vessels with propeller units of the described kind, wherein the motor 1, providing the driving power for the propeller shaft, as well as any gearbox, are disposed inside a special chamber 3, which is located outside the hull 5 of the ship, said chamber 3 being supported rotatably in relation to said hull 5.

The chamber 3, containing the motor 1, is rotatably supported in relation to the hull of the ship by the hollow shaft 4, which is extending through the bottom of the ship. Thus, the unit is turnable relative the hull 5, whereby it, instead of any separate rudder equipment, can also be used for steering the vessel. Among others, the FI patent No. 76977, to the present applicant, discloses such a propulsion unit in more detail. These units are also generally called azimuthing propulsion units, and the present applicant, for example, is offering such azimuthing units under the trade name AZIPOD ®.

In addition to the advantages gained from the elimination of a long propeller shaft and separate rudder equipment, these devices have been found to provide essential improvement in the maneuverability of a vessel. The energy economy of the vessel has also been found to become more efficient. In recent years, the use of azimuthing propulsion units in various vessels for water-borne traffic has become more common, and they are assumed to grow increasingly popular.

Figure 2 shows a prior art propulsion unit with its turning arrangement. The propulsion unit according to prior art comprises a motor unit 6, a propeller 7, a supporting part 8, and a cabling unit 9 and motor units 10, 11 of the turning arrangement. The motor unit 6 and the propeller 7 of the propulsion unit are being supported at the hull of the ship by the supporting part 8. The driving electric power is supplied to the electric motor unit 6 by the cabling unit 9. The motor units 10, 11 of the prior art turning arrangement turn the propulsion unit via a suitable gear set. The prior art propulsion unit also comprises mechanical brake means for reducing and/or limiting the turning speed of the azimuthing propulsion unit.

Figure 3 shows a power supply arrangement according to prior art for propulsion units. The prior art power supply arrangement for propulsion units comprises engine units 12, generator units 13, electrical power network switching panels 14, transformer units 15 for the propulsion system, frequency converters 16 for the propulsion units, frequency converters 17, 18 for the turning arrangement, propulsion units 19, 20 and a steering system 21.

In the power supply system according to prior art, the engine units 12 produce the power and the generator units 13 convert it to electric energy as input to the electrical power network. In the electrical power network, the electric power is directed, via the switching panels 14 and the transformer units 15 for the propulsion system, to the frequency converters 16 for the propulsion units and the frequency converters 17, 18 for the turning arrangement. The frequency converters 16-18 further establish the driving voltages to the motors for the propellers and the turning arrangements of the propulsion units 19, 20. The task of the steering system 21 is to control the operation of the turning arrangement.

The operating principle of the frequency converter 16-18 is a technique known to a person skilled in the art, and thus it need not be explained here, except by mentioning, that the main general parts of a frequency converter are a rectifier, an intermediate direct-current circuit and an invertor. Presently frequency converters 16-18 are commonly used, for instance, as supply devices for alternating-current motors, while being particularly preferable in various controllable electric drives. Frequency converters called PWM frequency converters (PWM, pulse width modulation), which are based on the pulse width modulation technique and have a so called voltage intermediate circuit, are the frequency converters being utilized the most frequently.

Should one or more of the propellers get damaged, it should be possible to move the vessel for service. The problem is, that should the vessel be moved, the damaged propeller will easily start rotating and causes additional damage to the propulsion device and possibly also to the vessel.

Accordingly, should there occur a break-down in the electric power supply to the motors in the turning arrangement for the propulsion unit, a sudden turning of the propulsion unit might cause additional damage to the propulsion device and possibly also to the vessel. If the propulsion device is free recklessly to turn this way and that, the maneuverability of the vessel is considerably impaired.

In propulsion units according to prior art, braking means operating mechanically have been devised. The object of the braking means is to prevent rotation of the propeller and to restrain the propeller essentially in a standard position or, respectively, to prevent the turning movement of the propulsion unit and to restrain the propulsion unit essentially in a standard position.

Summary of the present invention

The object of the present invention is to eliminate the disadvantages of prior art and to provide a novel solution for reducing and/or limiting the speed of a motor of a propulsion unit.

An object of the invention is to provide a solution, in which the use of any separate mechanical brake means and problems related to such means will be avoided.

An object of the invention is to provide a solution, in which the use of any separate mechanical brake means, as the propulsion unit is recklessly turning, can be avoided.

An object of the invention is to provide a solution, by which the reliability and the overall economy of the turning ma-

chinery of an azimuthing propulsion unit are improved compared to the known solutions.

According to a first aspect of the present invention a system is provided for reducing the speed and/or limiting the motion of a motor of a propulsion unit, said system comprising a propulsion unit, a propeller, a propeller motor, said propeller motor containing a magnetization device, and a frequency converter connected to an electrical power network, the system being characterized in, that the system further comprises a switch arrangement, which switch arrangement comprises means for disconnecting the propeller motor from the electrical power network and means for essentially short-circuiting the stator windings of the propeller motor.

Preferably, when a need for braking the propeller motor is detected, first, the propeller motor is disconnected from the electrical power network, after which the stator windings of the propeller motor are switched into a short-circuit. Alternatively, when a need for braking the propeller motor is detected, first, the propeller motor is disconnected from the electrical power network, after which the stator windings of the propeller motor are switched into a short-circuit within the frequency converter. Preferably the short-circuit is switched using semiconductors.

Preferably, the short-circuit is implemented such, that the stator windings of the propeller motor simultaneously are also connected to equipment ground. Preferably, the switch arrangement is controlled by a control section of the frequency converter.

Preferably, a synchronous motor is used as the propeller motor of the propulsion unit. Preferably, the braking system is implemented for switching more than one propulsion unit.

According to another aspect of the invention, a system is provided for reducing the speed and/or limiting the motion of a motor of a propulsion unit, said system comprising a propulsion unit, a propeller, motor units of the turning arrangement, said motor units containing a magnetization device, and a frequency converter connected to an electrical power network, the system being characterized in, that the system further comprises a switch arrangement, which switch arrangement comprises means for disconnecting the motor units from the electrical power network and means for essentially short-circuiting the stator windings of motor units.

Preferably, when a need for braking the motor units is detected, first, the motor units are disconnected from the electrical power network, after which the stator windings of the motor units are switched into a short-circuit. Alternatively, when a need for braking the motor units is detected, first, the motor units are disconnected from the electrical power network, after which the stator windings of the motor units are switched into a short-circuit within the frequency converter. Preferably the short-circuit is switched using semiconductors.

Preferably, the short-circuit is implemented such, that the stator windings of the motor units simultaneously are also connected to equipment ground. Preferably, the switch arrangement is controlled by a control section of the frequency converter.

Preferably, synchronous motors are used as the motor units of the turning arrangement of the propulsion unit. Preferably, the braking system is implemented for switching more than one propulsion unit.

According to a third aspect of the invention, a method is provided for reducing the speed and/or limiting the motion of a motor of a propulsion unit in a system comprising a propulsion unit, a propeller, a propeller motor, said propeller motor containing a magnetization device, and a frequency converter connected to an electrical power network, and a switch arrangement, the method being characterized in that first, a need for braking a propeller motor is detected, next, the propeller motor is disconnected from the electrical power network, after which the stator windings of the propeller motor are short-circuited.

Preferably, before the stator windings of the propeller motor are short-circuited, a check is made to ensure, that the propeller motor is disconnected from the electrical power network. Preferably, the braking method is implemented for switching more than one propulsion unit.

According to a fourth aspect of the invention a method is provided for reducing the speed and/or limiting the motion of a motor of a propulsion unit in a system comprising a propulsion unit, a propeller, motor units of the turning arrangement, said motor units containing a magnetization device, and a frequency converter connected to an electrical power network, and a switch arrangement, the method being characterized in that first, a need for braking motor units is detected, next, the motor units are disconnected from the elec-

trical power network, after which the stator windings of the motor units are short-circuited.

Preferably, before the stator windings of the motor units are short-circuited, a check is made to ensure, that the motor units are disconnected from the electrical power network. Preferably, the braking method is implemented for switching more than one propulsion unit.

Several considerable advantages are achieved by the present invention. It enables the replacement of the known system based on the use of mechanical brake means and thus the elimination of the problem items mentioned above. There is good overall economy in the solution based on utilizing the electric motor. The braking arrangement based on the electric drive is also extremely reliable.

The basic elements needed for the braking solution based on the use of an electric motor already exist in modern vessels, and, accordingly, the construction of a separate mechanical braking system is avoided.

Brief description of the drawings

The present invention is described below in detail with reference to the accompanying figures, in which:

Figure 1 shows the structure of a propulsion unit according to prior art,

Figure 2 shows a prior art propulsion unit and its turning arrangement,

Figure 3 shows a prior art power supply arrangement for propulsion units,

Figure 4 shows a system according to the present invention for braking a motor of a propulsion unit,

Figure 5 shows a typical short-circuit curve for a permanently magnetized motor of a propulsion unit according to the present invention,

Figure 6 shows an alternative system according to the present invention for braking a motor of a propulsion unit,

Figure 7 shows a method according to the present invention for braking a motor of a propulsion unit,

Figure 8 shows an alternative method according to the present invention for braking a motor of a propulsion unit, and

Figure 9 shows another alternative method according to the present invention for braking a motor of a propulsion unit.

Figures 1 - 3 were described above. The solution according to the present invention is presented below with reference to Figures 4 - 9, which show the implementation of a solution according to the present invention.

Detailed description of specific embodiments

Figure 4 shows a system according to the present invention for braking a motor of a propulsion unit. The braking system for a motor of a propulsion unit according to the invention comprises a load 22 of the propulsion unit, a permanently magnetized motor 23 of the propulsion unit, a frequency converter 25 connected to an electrical power network 24, and a switch arrangement 26. As the load 22 there may be either a propeller 22 or a turning device 22 for the propulsion unit.

Reference number 27 indicates a control section of the frequency converter.

The switch arrangement 26, according to the present invention, of the braking system for the motor of the propulsion unit comprises means for disconnecting the motor 23 from the electrical power network, and means for short-circuiting the stator windings of the permanently magnetized motor 23. When a need for braking the motor 23 is detected, first the motor 23 is disconnected from the electrical power network. Subsequently he stator windings of the motor 23 are switched into a short-circuit. The short-circuit can also be implemented such, that the stator windings of the motor 23 simultaneously are connected to equipment ground.

The switch arrangement 26 can be controlled e.g. by the control section 27 of the frequency converter. For example a synchronous motor 23 can be utilized as the permanently magnetized motor 23 of the propulsion unit. The motor units 10, 11 of the turning arrangement can, for example, also constitute the permanently magnetized motors 23. The braking method, according to the present invention, for a motor of a propulsion unit can also be implemented for switching more than one motor.

Figure 5 shows a typical short-circuit curve of a permanently magnetized motor of a propulsion unit according to the present invention. The short-circuit curve of the motor is indicated by the reference numeral 28. When the stator windings of the permanently magnetized motor are short-circuited, the short-circuit moment is so large, that it is generously sufficient for resisting the moments induced by the ship's movements and sea currents. Thus at all times one stays to the

left of the moment curve's peak value. The rotational speed of the propeller is then less than 10 % of its nominal speed, typically about 2 - 5 % of the nominal speed.

Figure 6 shows an alternative system, according to the present invention, for braking a motor of a propulsion unit. The alternative braking system, according to the present invention, for a motor of a propulsion unit comprises a propeller 29, a permanently magnetized motor 30 of the propulsion unit, a frequency converter 32 connected to an electrical power network 31, and a switch arrangement 33. A control section of the frequency converter is indicated by the reference numeral 34.

The switch arrangement 33 of the braking system, according to the present invention, for a motor of a propulsion unit comprises means for disconnecting the motor 30 from the electrical power network and means for short-circuiting the stator windings of the permanently magnetized motor 30. When a need for braking the motor 30 is detected, first, the motor 30 is disconnected from the electrical power network. After that, the stator windings of the permanently magnetized motor 30 are switched into a short-circuit within the frequency converter 32.

The short-circuit implemented within the frequency converter can be switched also using semiconductors. For example, a synchronous motor 30 can be used as the permanently magnetized motor 30 of the propulsion unit. The short-circuit can also be implemented such, that the stator windings of the motor 30 simultaneously are connected to equipment ground.

The switch arrangement 33 can be controlled, for example, by a control section 34 of the frequency converter. The motor units 10, 11 of the turning arrangement, for example, can here also constitute the permanently magnetized motors 30. The braking system, according to the present invention, for a motor of a propulsion unit can also be implemented for switching more than one propulsion unit.

Figure 7 shows a method according to the present invention for braking a motor of a propulsion unit. The braking system for a motor of a propulsion unit according to the invention comprises a propeller, a permanently magnetized motor of the propulsion unit, a frequency converter connected to an electrical power network, and a switch arrangement. In the method according to the present invention, first, a need for braking the motor is detected 35. When the need for braking has been detected, the motor is disconnected 36 from the electrical power network. After that, the stator windings of the motor are short-circuited 37. The method for braking a motor of a propulsion unit according to the present invention can also be implemented for switching more than one motor.

Figure 8 shows an alternative method, according to the present invention, for braking a motor of a propulsion unit. The braking system for a motor of a propulsion unit according to the invention comprises a propeller, a permanently magnetized motor of the propulsion unit, a frequency converter connected to an electrical power network, and a switch arrangement. In the method according to the present invention, first, a need for braking the motor is detected 35. When the need for braking has been detected, the motor is disconnected 36 from the electrical power network. After the motor has been disconnected from the electrical power network, the disconnection

of the motor from the electrical power network is checked 38. After that, the stator windings of the motor are short-circuited 37. The method for braking a motor of a propulsion unit, according to the present invention, can also be implemented for switching more than one propulsion unit.

Figure 9 shows another alternative method, according to the present invention, for braking a motor of a propulsion unit. The braking system for a motor of a propulsion unit according to the invention comprises a propeller, a permanently magnetized motor of the propulsion unit, a frequency converter connected to an electrical power network, and a switch arrangement. The motor units 10, 11 of the turning arrangement, for example, can here also constitute the permanently magnetized motors. In the method according to the present invention, first, absence of supply power to the motor is detected 39. When absence of supply power has been detected, the stator windings of the motor are short-circuited 40. The alternative method for braking a motor of a propulsion unit according to the present invention can also be implemented for switching more than one propulsion unit.

Thus, a device and a method have been provided by the present invention, by which a novel solution for braking a motor of a propulsion unit of a vessel is achieved. By the solution, several disadvantages of prior art are avoided, while achieving an advantage with regard to a simpler design and a better overall economy as well as ease of use and operational reliability.

It is to be appreciated, that the examples of embodiments of the present invention presented above are not limiting the scope of the invention as defined in the patent claims, but

rather that the claims are intended to cover all modifications, similarities and alternatives included in the spirit and scope of the invention as defined in the accompanying patent claims.

Patent claims

1. A system for reducing the speed and/or limiting the motion of a motor of a propulsion unit, said system comprising a propulsion unit, a propeller (22), (29), a propeller motor (23), (30), said propeller motor containing a magnetization device, and a frequency converter (25), (32) connected to an electrical power network (24), (31), **characterized** in, that the system further comprises a switch arrangement (26), (33), which switch arrangement (26), (33) comprises means for disconnecting the propeller motor (23), (30) from the electrical power network and means for essentially short-circuiting the stator windings of the propeller motor (23), (30).

2. A system according to claim 1, **characterized** in that when a need for braking the propeller motor (23) is detected, first, the propeller motor (23) is disconnected from the electrical power network, after which the stator windings of the propeller motor (23) are switched into a short-circuit.

3. A system according to claim 1, **characterized** in that when a need for braking the propeller motor (30) is detected, first, the propeller motor (30) is disconnected from the electrical power network, after which the stator windings of the propeller motor (30) are switched into a short-circuit within the frequency converter (32).

4. A system according to claim 3, **characterized** in that the short-circuit is switched using semiconductors.

5. A system, according to claim 2, 3 or 4, **characterized** in that the short-circuit is implemented such, that the stator

windings of the propeller motor (23), (30) simultaneously are also connected to equipment ground.

6. A system according to any one of the preceding claims 2-5, **characterized** in that the switch arrangement (26), (33) is controlled by a control section (27), (34) of the frequency converter.

7. A system according to any one of the preceding claims 2-6, **characterized** in, that a synchronous motor (23), (30) is used as the propeller motor (23), (30) of the propulsion unit.

8. A system according to any one of the preceding claims 1-7, **characterized** in, that the braking system is implemented for switching more than one propulsion unit.

9. A system for reducing the speed and/or limiting the motion of a motor of a propulsion unit, said system comprising a propulsion unit, a propeller (22), (29), motor units (10), (11) of the turning arrangement, said motor units (10), (11) containing a magnetization device, and a frequency converter (25), (32) connected to an electrical power network (24), (31), **characterized** in, that the system further comprises a switch arrangement (26), (33), which switch arrangement (26), (33) comprises means for disconnecting the motor units (10), (11) from the electrical power network and means for essentially short-circuiting the stator windings of motor units (10), (11).

10. A system according to claim 9, **characterized** in that when a need for braking the motor units (10), (11) is detected, first, the motor units (10), (11) are disconnected

from the electrical power network, after which the stator windings of the motor units (10), (11) are switched into a short-circuit.

11. A system according to claim 9, **characterized** in that when a need for braking the motor units (10), (11) is detected, first, the motor units (10), (11) are disconnected from the electrical power network, after which the stator windings of the motor units (10), (11) are switched into a short-circuit within the frequency converter (32).

12. A system according to claim 11, **characterized** in that the short-circuit is switched using semiconductors.

13. A system, according to claim 10, 11 or 12, **characterized** in that the short-circuit is implemented such, that the stator windings of the motor units (10), (11) simultaneously are also connected to equipment ground.

14. A system according to any one of the preceding claims 10-13, **characterized** in that the switch arrangement (26), (33) is controlled by a control section (27), (34) of the frequency converter.

15. A system according to any one of the preceding claims 10-14, **characterized** in, that synchronous motors (10), (11) are used as the motor units (10), (11) of the turning arrangement of the propulsion unit.

16. A system according to any one of the preceding claims 9-15, **characterized** in, that the braking system is implemented for switching more than one propulsion unit.

17. A method for reducing the speed and/or limiting the motion of a motor of a propulsion unit in a system comprising a propulsion unit, a propeller (22), (29), a propeller motor (23), (30), said propeller motor containing a magnetization device, and a frequency converter (25), (32) connected to an electrical power network (24), (31), and a switch arrangement (26), (33) **characterized** in, that in the method according to the invention, first, a need for braking a propeller motor (23), (30) is detected (35), next, the propeller motor (23), (30) is disconnected (36) from the electrical power network (24), (31), after which the stator windings of the propeller motor (23), (30) are short-circuited (37).

18. A method according to claim 17, **characterized** in that before the stator windings of the propeller motor (23), (30) are short-circuited (37), a check is made to ensure (38), that the propeller motor (23), (30) is disconnected from the electrical power network.

19. Method, according to claim 17 or 18, **characterized** in that the braking method is implemented for switching more than one propulsion unit.

20. A method for reducing the speed and/or limiting the motion of a motor of a propulsion unit in a system comprising a propulsion unit, a propeller (22), (29), motor units (10), (11) of the turning arrangement, said motor units (10), (11) containing a magnetization device, and a frequency converter (25), (32) connected to an electrical power network (24), (31), and a switch arrangement (26), (33) **characterized** in, that in the method according to the invention, first, a need for braking motor units (10), (11) is detected (35), next, the motor units (10), (11) are disconnected (36) from the

electrical power network (24), (31), after which the stator windings of the motor units (10), (11) are short-circuited (37).

21. A method according to claim 20, **characterized** in that before the stator windings of the motor units (10), (11) are short-circuited (37), a check is made to ensure (38), that the motor units (10), (11) are disconnected from the electrical power network.

22. Method, according to claim 20 or 21, **characterized** in that the braking method is implemented for switching more than one propulsion unit.

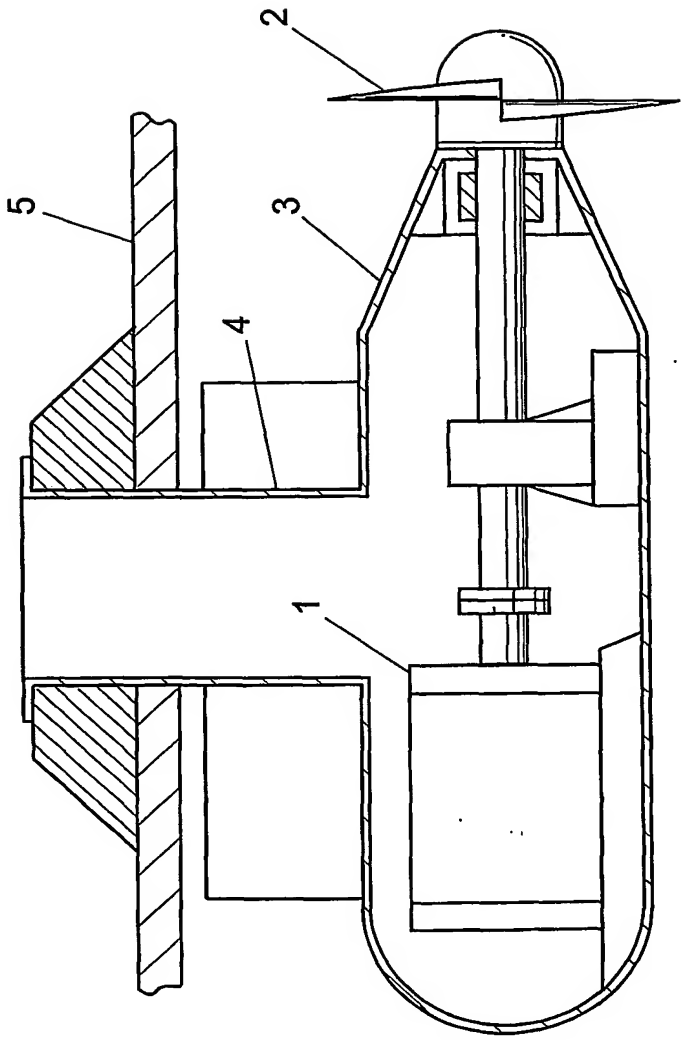


Fig. 1

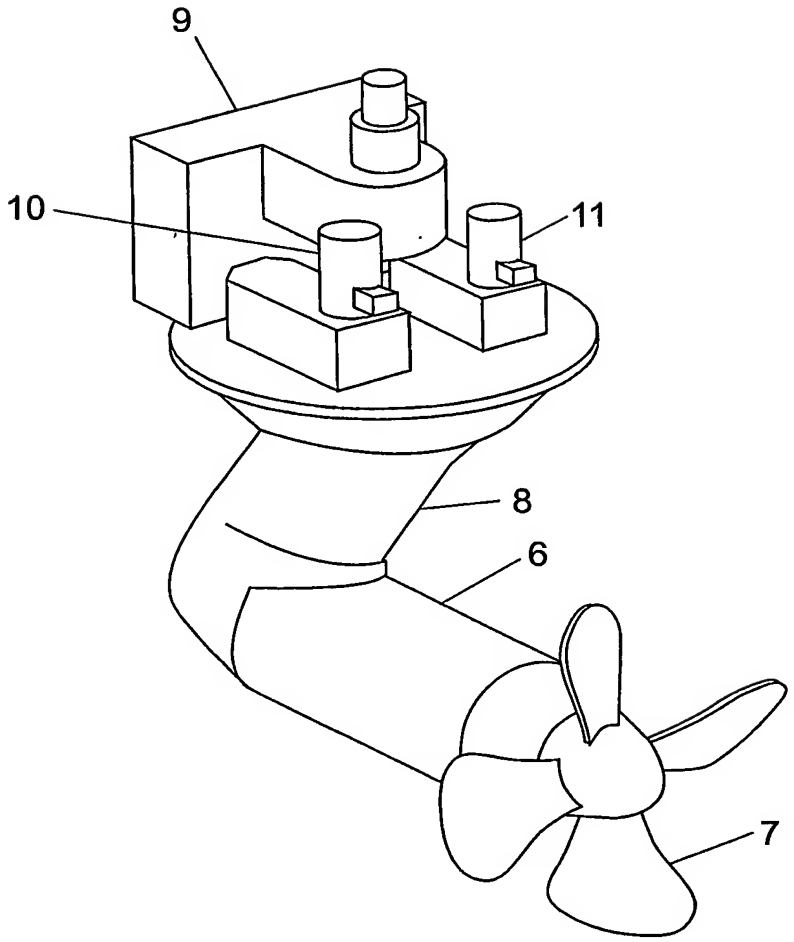


Fig. 2

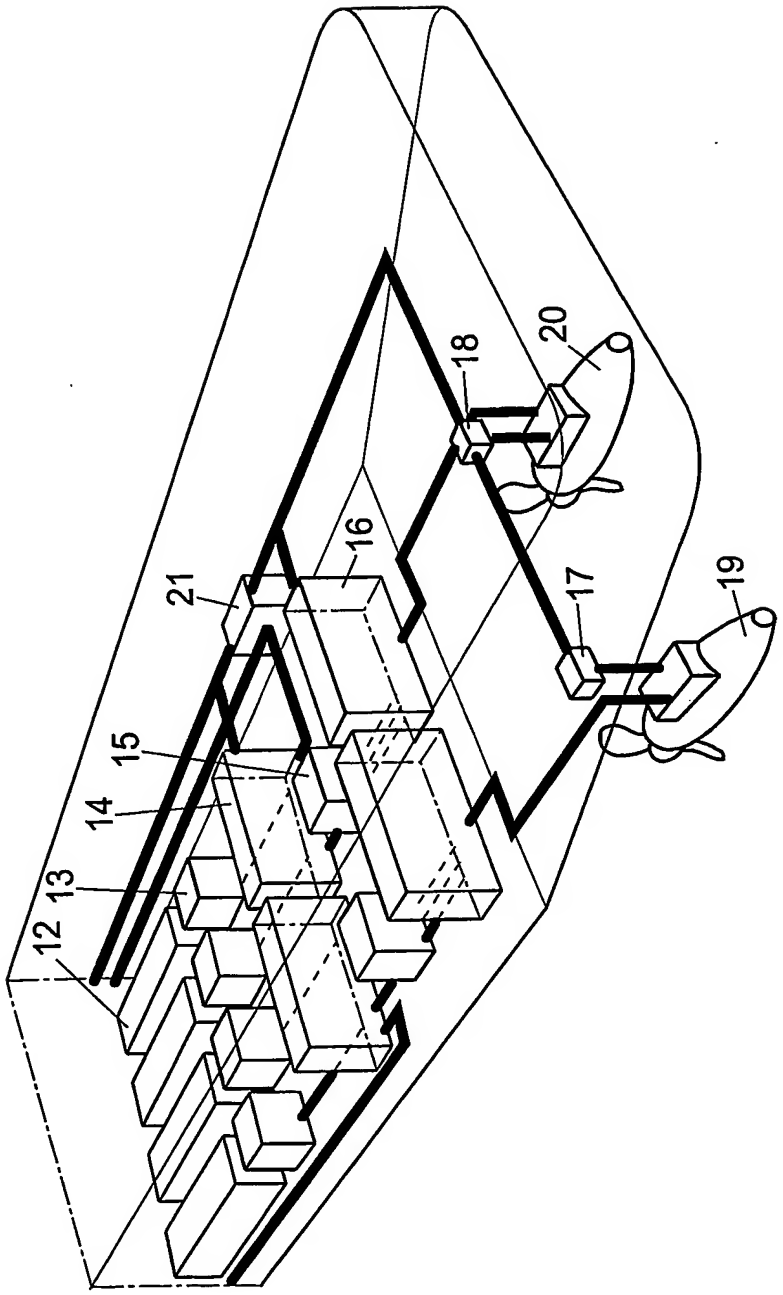


Fig. 3

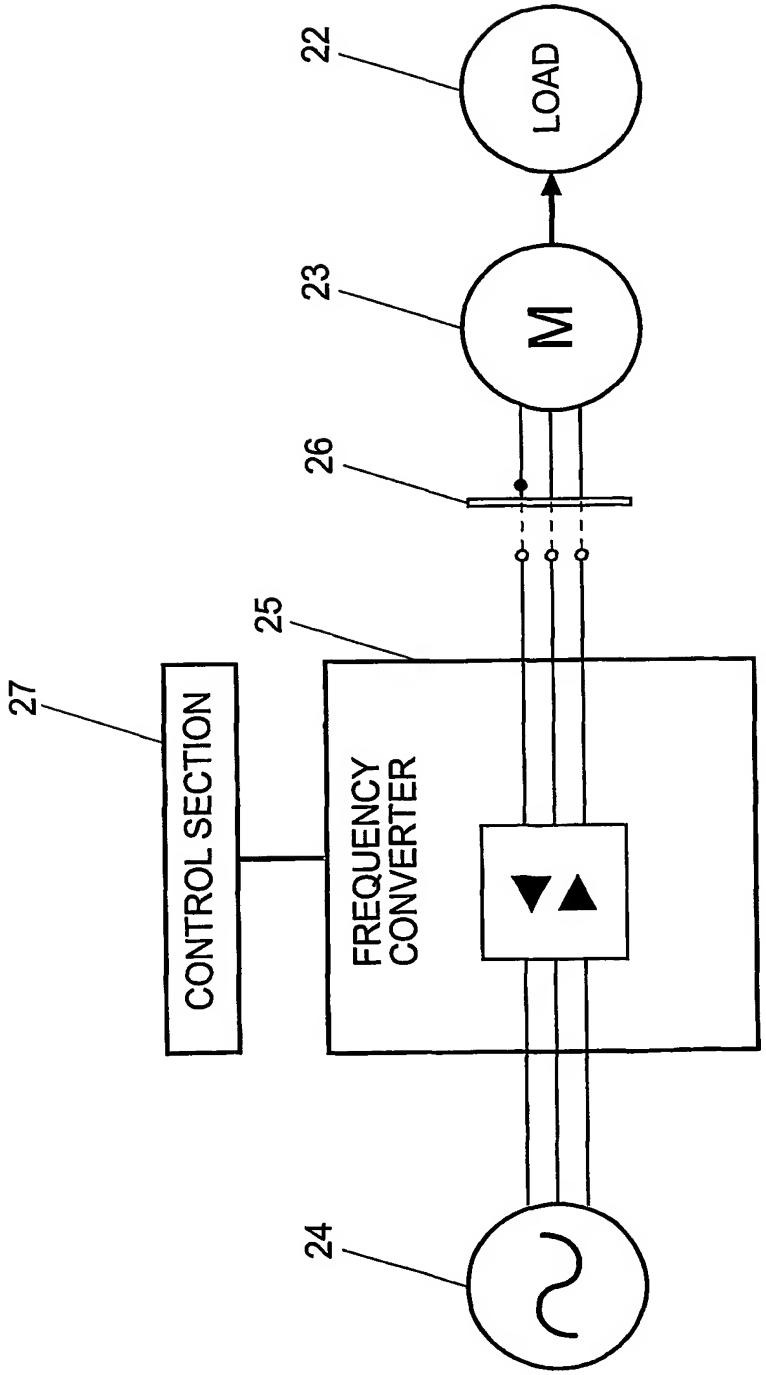


Fig. 4

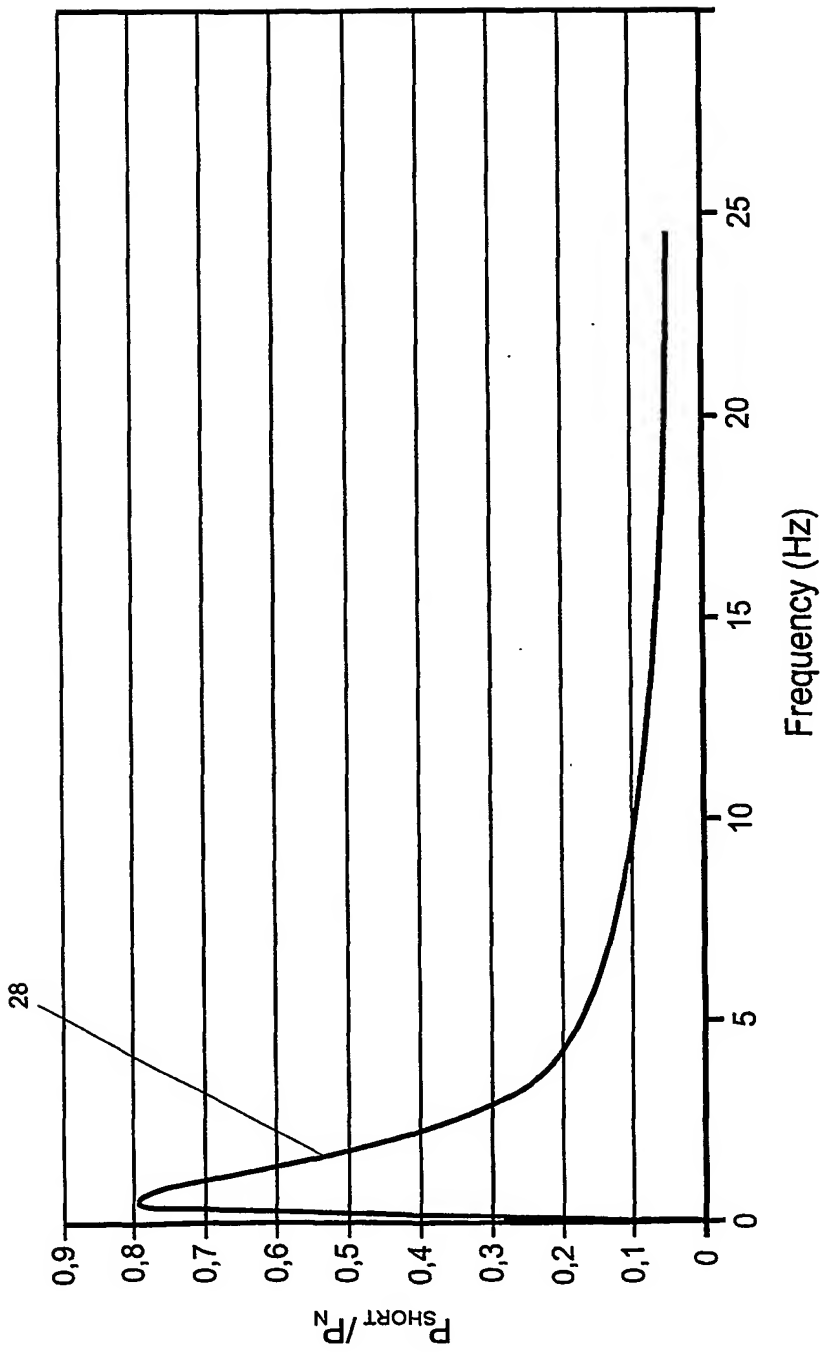

28
0,9
0,8
0,7
0,6
0,5
0,4
0,3
0,2
0,1
0
P_{SHORT}/P_N
0
5
10
15
20
25
Frequency (Hz)

Fig. 5

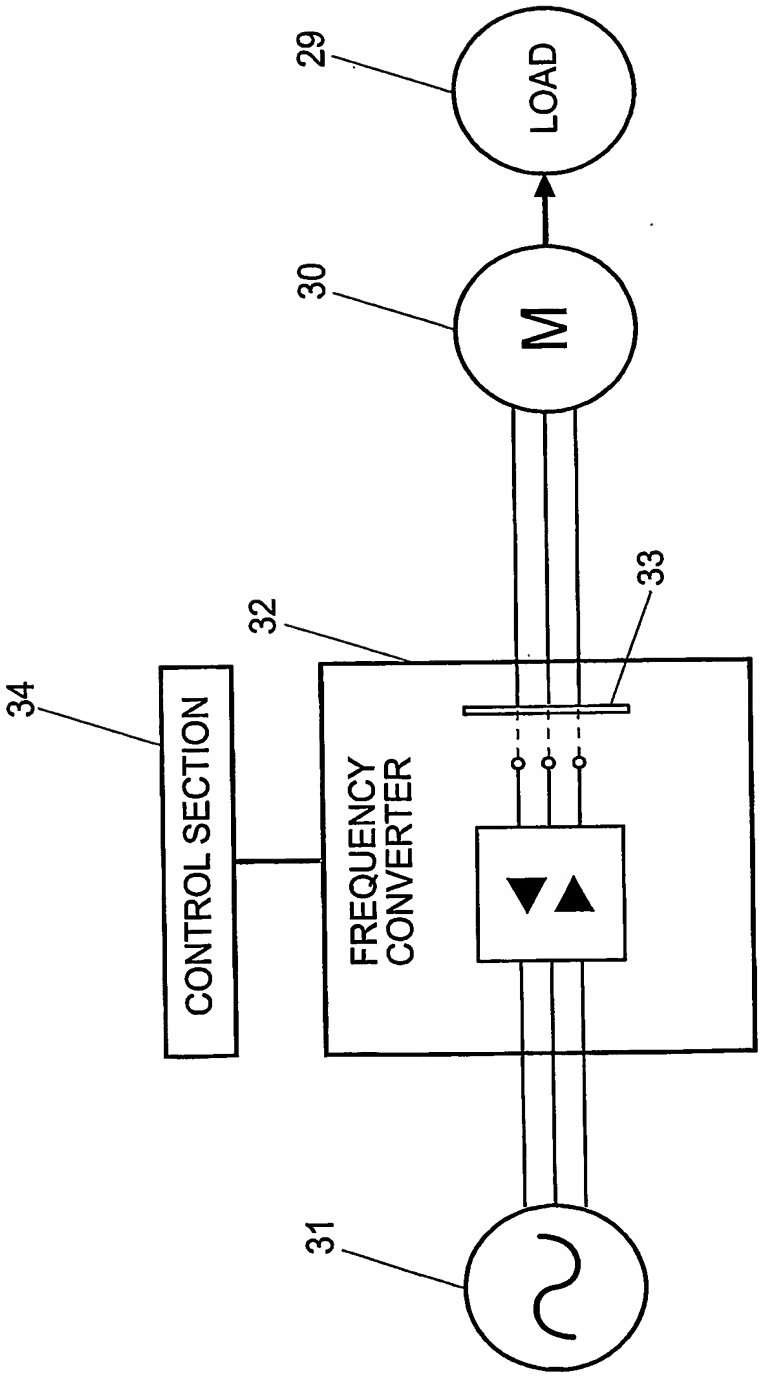


Fig. 6

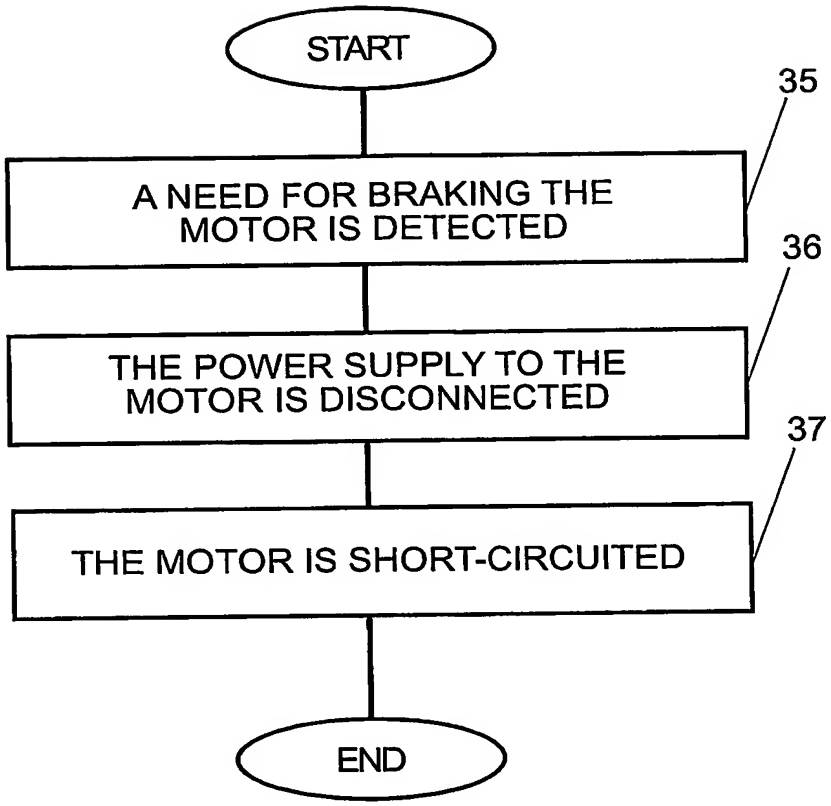

START
35
A NEED FOR BRAKING THE MOTOR IS DETECTED
36
THE POWER SUPPLY TO THE MOTOR IS DISCONNECTED
37
THE MOTOR IS SHORT-CIRCUITED
END

Fig. 7

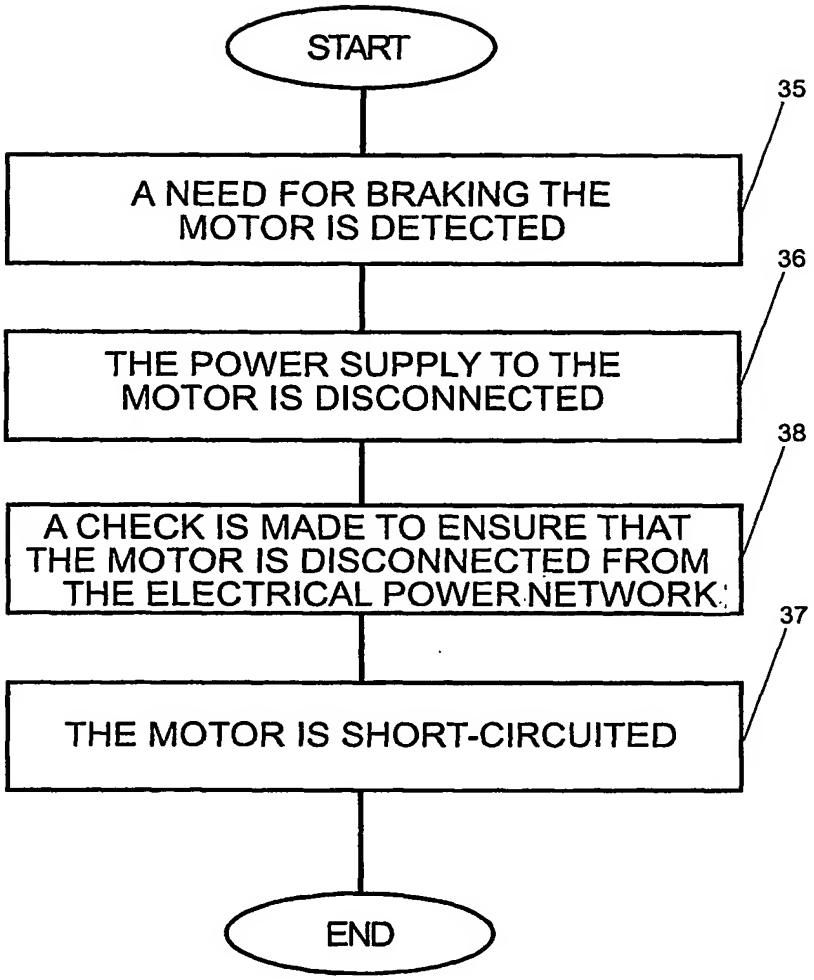

START
35
A NEED FOR BRAKING THE MOTOR IS DETECTED
36
THE POWER SUPPLY TO THE MOTOR IS DISCONNECTED
38
A CHECK IS MADE TO ENSURE THAT THE MOTOR IS DISCONNECTED FROM THE ELECTRICAL POWER NETWORK
37
THE MOTOR IS SHORT-CIRCUITED
END

Fig. 8

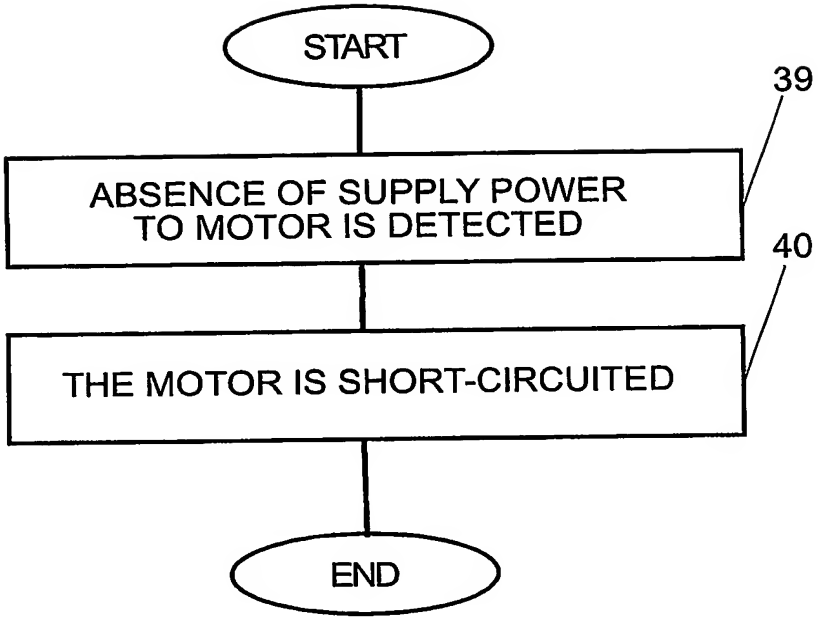

START
39
ABSENCE OF SUPPLY POWER TO MOTOR IS DETECTED
40
THE MOTOR IS SHORT-CIRCUITED
END

Fig. 9

INTERNATIONAL SEARCH REPORT

International Application No
PCT/FI 03/00244

A. CLASSIFICATION OF SUBJECT MATTER
IPC 7 H02P3/22 B63H23/24 B60L15/20

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC 7 H02P B63H B60L

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)
EPO-Internal, WPI Data, PAJ

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	US 4 338 525 A (KILGORE LEE A) 6 July 1982 (1982-07-06) page 7, line 23 -page 8, line 7; figure 1	1-22
Y	DE 26 20 346 A (LINDE AG) 17 November 1977 (1977-11-17) the whole document	1-22
A	SU 901 099 A (MO I INZHENEROV ZHELEZNODOROZH) 30 January 1982 (1982-01-30) the whole document	1-22

☐ Further documents are listed in the continuation of box C.

☒ Patent family members are listed in annex.

° Special categories of cited documents :

"A" document defining the general state of the art which is not considered to be of particular relevance

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"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.

"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
24 July 2003	08 AUG 2003

Name and mailing address of the ISA	Authorized officer
European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Tx. 31 651 epo nl, Fax: (+31-70) 340-3016	KERSTIN WACZINSKA/MN

Form PCT/ISA/210 (second sheet) (July 1992)

INTERNATIONAL SEARCH REPORT

Information on patent family members

International Application No
PCT/FI 03/00244

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 4338525 A	06-07-1982	CA 1161930 A1	07-02-1984
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		NL 7705005 A	09-11-1977
		SE 7705317 A	08-11-1977
SU 901099 A	30-01-1982	SU 901099 A1	30-01-1982